

seen in 1793, was derived which may be regarded as very near the truth. But apart from these and a few other observations it must be confessed that little is certainly known with reference to irregular markings on Saturn. Hall, with the 26-inch Washington refractor, Barnard, with the 36-inch Lick refractor and other telescopes, Young, with the 23-inch at Princeton, Hough, with the 18½-inch at Chicago, and others have all systematically endeavoured to distinguish spots on the planet's globe and all have failed, except in the particular case alluded to. The cream of observational talent, assisted by the finest and best telescopes ever constructed, has proved that irregular markings sufficiently well pronounced to be distinctly visible are somewhat of a rarity. Yet it should be stated that certain other observers discern alleged spots with ease and in prolific numbers as well as under many varieties of shape and tint. Indeed, the Saturnian spots would appear to be as frequent and to have as many vagaries as the markings on Jupiter if we may accept the testimony of a few observers. Whether these things are objective realities or the products of visionaries remains to be proved by the severe tests which future researches will apply.

Saturn comes to conjunction with Jupiter at intervals of about twenty years, previous conjunctions having occurred on April 22, 1881, October 25, 1861, January 26, 1842, June 19, 1821, July 16, 1802, &c. The ensuing conjunction takes place on the morning of November 28 next at 6 h., when Jupiter will be 0° 27' south of Saturn. In 1881 the planets were 1° 18' apart, in 1861 0° 52'. Mr. Crommelin gives the results of some computations in the *Monthly Notices*, lxi. p. 118, which show that the distance of the centres of the two planets will be less than 1° between November 21 and December 5. The near approach of these attractive objects will form an event of considerable interest to the general public as well as to the astronomical world.

W. F. DENNING.

### MARINE BIOLOGY IN LIVERPOOL.

THE Editor of NATURE invites me to write a short account of the marine biological investigations and the scientific fisheries work carried on of late years in the Liverpool district, and I have pleasure in complying with this request since it will enable me both (1) to acknowledge the services of friends and fellow-workers, and (2) to distinguish between three very different local bodies whose work is frequently—and perhaps not unnaturally—confounded even by marine biologists and even in Liverpool. These three bodies are the Liverpool Biological Society, the Liverpool Marine Biology Committee, and the Lancashire Sea-Fisheries Committee. They are perfectly distinct in organisation, control and object, and although the work they do is to some extent similar, still, as a result of friendly arrangement and cooperation, there has been absolutely no rivalry and no overlap or duplication of work such as might under other circumstances cause waste of time, funds and opportunity. Let me state briefly the position and work of each of these three bodies, all of which are now contributing actively to the elucidation of the marine biology of the Irish Sea.

**I. Liverpool Biological Society.**—This is a public scientific society in the town, like its well-known sister society, the Liverpool Geological Society. It meets monthly in the zoological department of University College, and all local lovers of nature are eligible for membership. The president this session is Prof. A. M. Paterson, and the hon. secretary Mr. J. A. Clubb, of the Free Public Museum. The past presidents include the professors of all the biological departments in University College (anatomy, physiology, botany and zoology), the head officials of the Public Museum and such well-known local biologists as the late Dr. Drysdale, Dr. Wigglesworth and Mr. Isaac Thompson. The Society is now publishing its fifteenth annual volume of *Proceedings and Transactions*. The *Proceedings* at the beginning of the volume contain a brief record of the proceedings at the meetings, including exhibits; while the *Transactions* consist of those papers which the council decides to print in full. Although the greater number of the papers in the published volumes deal with the marine animals and plants of the district, still biology in the widest sense is represented at the meetings and in the publications, and communications will be found on ornithology, entomology, palæontology, embryology,

botany, anatomy, physiology and even archæology. It has been customary for the president in each session to invite some outside original worker in his own department of biology to come and address the Society. In this way important lectures have been given by Drs. Gaskell, Sorby and D. H. Scott, and by Profs. Howes, Haddon, Miall and others. The address this year will be given by Prof. D. J. Cunningham, on the lessons to be drawn from the condition of the skull and the brain in the microcephalic idiot.

**II. Liverpool Marine Biology Committee.**—This, in contradistinction to the Biological Society, is a private body. It is not a Committee of the Society or of anything else, but is an independent organisation. It was constituted at a meeting of biologists held at University College in March, 1885, for the purpose of carrying out a scheme of investigation of the local marine fauna and flora with the intention of publishing reports thereon. The dredging, trawling and other collecting expeditions organised by the Committee have been carried on intermittently since that time, and a considerable amount of material, both published and unpublished, has been accumulated. Fourteen annual reports of the Committee and five volumes dealing with the fauna and flora have been issued since 1886.

At an early stage of these investigations it became evident that a biological station or laboratory on the sea-shore, somewhere nearer the usual collecting grounds than Liverpool, would be a material assistance in the work. Consequently, the Committee in 1887 acquired a lease of Puffin Island, on the north coast of Anglesey, and established there the L.M.B.C. Puffin Island Station,<sup>1</sup> which formed the centre of their work at sea for five years. Later on, in 1892, finding that their work was extending, and that the very limited accommodation at Puffin Island was insufficient, they moved to the more commodious and more convenient biological station at Port Erin,<sup>2</sup> in the centre of the rich collecting grounds of the south end of the Isle of Man. This locality has proved so interesting and so perfectly suitable in every way that it is likely to remain as the permanent marine laboratory of the Liverpool naturalists; while the office of the Committee, the place of meetings, the publishing centre and the museum, is the zoological department of University College, Liverpool.

The Committee consists of twelve members who were chosen originally as being representative naturalists of Liverpool, Manchester, Southport, Chester and the Isle of Man—and most of these members are still active workers. Amongst our losses, by death, are Prof. Milnes Marshall, the Rev. H. H. Higgins and Mr. Francis Archer. The Committee subscribe amongst themselves and ask for contributions from their friends in Liverpool. In this way, aided by occasional grants from the British Association and other bodies, they have paid the expenses of numerous dredging expeditions, have maintained their small biological station, with a resident curator (now Mr. Herbert C. Chadwick), for fifteen years and have issued a considerable number of publications. The regular income for the last few years has averaged about 200*l.* per annum, but in addition several friends in Liverpool, amongst whom may be mentioned Mrs. George Holt and Mr. F. H. Gossage, have kindly placed sums in the hands of the present writer to be expended either in special expeditions or in the publication of memoirs requiring plates. Thus it will be seen that the funds at the disposal of the Committee, although, thanks to the generosity of friends and the economical management of our hon. treasurer, Mr. Thompson, they have sufficed up to the present, are evidently too small and too precarious to admit of much advance; and consequently an appeal will sooner or later have to be made for a permanent endowment of the Port Erin Biological Station.

The publications of the L.M.B.C. consist of:—(1) the annual report, issued primarily to subscribers and other friends in Liverpool. Although this report gives a brief account of the investigations undertaken during the year, still it is to be regarded, not mainly as a scientific, but rather as a business publication for the purpose of keeping the organisation together and in touch with the people of Liverpool. (2) The volumes of the "Fauna of Liverpool Bay," containing reprints of those papers communicated by members of the Committee, and others working at the laboratory, to the Liverpool Biological Society, and which deal with the local fauna and flora. These volumes are bound and issued at irregular intervals when sufficient material has accumulated.

<sup>1</sup> See NATURE, vol. xxxvi. p. 275.

<sup>2</sup> See NATURE, vol. xlvii. p. 255.

Five volumes have now appeared, bearing the dates 1886, 89, 92, 95 and 1901. (3) The "L.M.B.C. Memoirs," a series of detailed descriptions of the structure of certain common typical animals and plants, chosen as representatives of their groups and dealt with by specialists. Memoirs on the following types have already appeared or are in the press: I. *Ascidia*, II. *Cardium*, III. *Echinus*, IV. *Codium*, V. *Alcyonium*, VI. *Lepeophtheirus* and *Lernaea*, and VII. *Lineus*. Several others are nearly ready, and about thirty-five in all have been arranged for. Amongst other L.M.B.C. workers whose names have not been mentioned are Mr. A. O. Walker, Mr. Arnold Watson, Mr. A. Leicester and Prof. Harvey Gibson.

III. *Lancashire Sea-Fisheries Committee*.—The district controlled by this Committee (recently amalgamated with the former Western Sea-Fisheries District to form what is now officially styled "The Lancashire and Western Sea-Fisheries District") is probably the largest, and in several respects the most important, of the sea-fisheries districts which have been established since 1890, in connection with the County Councils, round the coasts of England and Wales, under the Sea-Fisheries Regulation Act of 1888. The district extends from the Duddon, in Cumberland, to Cardigan, in South Wales, and thus runs for about 441 statute miles along the shores of the Irish Sea. It bounds in all nine counties and contains about 1500 square miles of sea. Nearly every kind of English sea-fishing is carried on within this district, including fish-trawling, line-fishing in all its branches, drift net, trammel net and draw net fishing; set nets and stake nets, weirs and hedge-baulks are also used. Besides these there is a very large shrimping industry which is carried on by the use of shrimp trawls, shank nets, hose nets and push nets. Lobsters, crabs and prawns are taken in many places, and there is a very large area of shell-fish beds—mussels, cockles and oysters.

The work of the Committee is mainly administrative, and is carried out by a superintendent, Mr. R. A. Dawson, who has at his command an efficient steamer and a staff of bailiffs. There is also a scientific department, of which the present writer is hon. director, and the work of which centres in Liverpool. In that department we have a central fisheries laboratory in University College, and a branch laboratory with sea-fish hatchery at Piel, near Barrow in the north of Lancashire. The fisheries assistant at Liverpool is Mr. James Johnstone, and the resident assistant in charge of the Piel Hatchery is Mr. Andrew Scott. Both these gentlemen are known to marine biologists by their investigations, those of Mr. Johnstone being on the mussel and the cockle, and those of Mr. Scott for the most part on Copepoda and fish-hatching.

The work of the scientific department of the Lancashire Sea-Fisheries is most varied throughout the year, and ranges from teaching fishermen and keeping up a fisheries museum to hatching fish, reporting on oysters, and carrying on research in regard to all kinds of fisheries problems. The following headings of sections in the last published annual report (the ninth) will give an idea of the scope of the work: required survey of fishing grounds, fish-hatching, spawning of mussel, statistics of shrimping grounds and fish, relation of deposits to shrimps, sporozoon parasite of the plaice, Copepod fish parasites, circulating fisheries exhibition, laboratory classes for fishermen, inspection of shell-fish beds, and the question of sewage contamination. In this report it is urged that "what we stand most in need of at present is full and accurate statistics in regard to our fisheries, and much more detailed information than we have as to the distribution round the coast both of fishes in all stages of growth and also of the lower animals with which they are associated and upon which they feed". . . "We must, in fact, get series of accurate observations which will give us fair samples of the more sedentary populations of our seas on the different grounds, such as trawling grounds, shrimping grounds, nurseries and spawning banks at the different seasons". . . "My contention, then, is that such an investigation of our seas must be made, that it is urgent and should be made now, and that the Irish Sea is favourably situated and circumstanced at present to be made a test case before undertaking the much wider and still more difficult expanse of the North Sea, complicated by international questions. The Irish Sea is of moderate and manageable dimensions. It is all bounded by British territory and by sea-fisheries authorities which might agree as to their regulations. It is a 'self-contained' fish area, containing both shallow and deep water, spawning banks, feeding grounds and nurseries. It has several laboratories (Liverpool, Dublin, Port Erin and

Piel) on its borders which would form centres for investigation, and it is controlled by powerful sea-fisheries authorities, two of which at least (Lancashire and Ireland) are provided with excellent steamers which might combine in the work. All that is required, beyond a carefully considered scheme, is authority from Government to the local committees to carry out such work, and a subsidy for, say, five years, to meet the increased expense." It is pointed out that there are two methods by which the required survey of our seas might be effected:—(1) By forming a properly equipped Government department (in some respects like the Geological Survey), with laboratories and steamers and a scientific staff competent to tackle the scientific problems involved; and (2) by making use of existing organisations, giving fuller powers to the local committees, and by encouraging and enabling them to spend money on the necessary investigations in their own districts.

It has been found in Liverpool that the only effective way of teaching fishermen is by means of practical classes. Lectures of all kinds, followed by discussions long and short, demonstrations microscopic and otherwise, have been tried in vain, or with only qualified success. Of course the brighter spirits amongst them, the picked men, can be instructed by any method, but for the average fisherman it takes the patient hammering of hour after hour and day after day in a laboratory class, where you appeal, not only to his ears, but also to his eyes and his fingers, and where he makes and remakes his own preparations, cleans his own cover-glasses and focusses the microscope for himself, before he can understand and will believe what he is told and sees, and finally becomes convinced, for example, that he is really looking at a young fish inside a minute transparent egg caught on the surface of the sea, or that what he and his fellows have always stoutly maintained to be the spawn of flat fishes is after all only the egg-capsule of an Annelid.

After deciding that this was the best plan to adopt in applying technical instruction to the fisheries, we started these laboratory courses in Liverpool last spring (February 1900). Two courses were held last year, two are being held this spring, and two others will follow later in the summer. The Technical Instruction Committee defrayed the expenses of the fishermen. That is, they gave 5/- to each man to meet his travelling expenses and his board and lodging in Liverpool during the fortnight he was under instruction. No charge was made for instruction or for the use of the microscopes, dissecting instruments, material and reagents—everything necessary was supplied by the laboratory. The teaching was carried on by Mr. Johnstone under my supervision, and the whole course was entirely practical in character, each man examining everything for himself and working every day, both forenoon and afternoon. For details as to the work of the course I must refer to our report, but I may say, in conclusion, that the results were most encouraging, and that from the reports of the superintendent of fisheries to his committee there can be no doubt as to the success of the method in the eyes of the fishermen and of the sea-fisheries officers.

I must now have nearly reached the limits which the Editor asked me not to exceed, and so I fear I must not enter upon further details, although I should have liked to have told how Mr. Thompson and Mr. Scott are working at the Copepoda, Mr. Chadwick and Mr. Ascroft at plankton, Mr. Johnstone and Dr. Jenkins at fishery statistics, Mr. Cole at the nerves of the flat fishes, and others of my excellent assistants and colleagues at various other special problems. But I must be content for the present with the above sketch of the local marine biological and fisheries work which centres in Liverpool, and with the following expression of my strong convictions on two points. I feel certain—

(1) That for such work the great thing is friendly co-operation. The field is so enormous and the work so varied in its nature that there is room and use for many individuals of very different capabilities. And if the work is to be carried on without Government subsidy or large endowments it is necessary to attract and combine various local organisations, such as University, County Council, local scientific societies, and that characteristically English product the serious amateur who does excellent original scientific work.

(2) That this work is only beginning, and that a great future lies before marine biology in all its branches, including the application of scientific methods to the investigation of fisheries problems.

W. A. HERDMAN.